Avaya™ S8300 Media Server Local Survivable Processor - Issue 1.3

Abstract

This document presents a discussion about the Avaya™ S8300 Media Server configured as a Local Survivable Processor (LSP). This discussion is intended to describe how the LSP provides the added layer of survivability and how to design a network to take full advantage of the LSP's capabilities. This document is targeted to a technical audience having some familiarity with Avaya's IP telephony products.

1. Introduction

Communication is the life-blood of any company, and ensuring that communications will be available at any time is critical. This is increasingly difficult to provide in today's changing environment from pure voice networks to converged data and voice networks. Avaya offers a strong line of products to assist in creating the most robust network possible. This portfolio of solutions includes the Avaya™ S8700 Media Server and the Avaya™ S8300 Media Server. The S8700 Media Server runs in duplex mode with a standby server ready to take control with no loss of communication should a cataclysmic event occur to the primary server. The duplicated S8700 Media Server protects the network against a server failure, but increasing distances between headquarters and remote branch offices increases the chance of a network facilities outage causing loss of communications. Avaya offers the Local Survivable Processor (LSP) to continue to provide service in the case of broken connectivity between remote sites and main locations. In addition, Avaya empowers the administrator with the ability to define how the system behaves in the case of lost network connectivity. The priority can be placed on maintaining a solid network or on a speedy switch to the LSP and short downtime.

This document is intended to describe how the LSP provides the added layer of survivability, how to administer the behavioral priorities, and how to design a network to take full advantage of the LSP's capabilities.

2. Overview

The Avaya Local Survivable Processor (LSP) solution utilizes the Avaya S8300 Media Server hardware and software components and requires an Avaya MultiVantage™ Software license to activate the LSP feature. This software license allows the S8300 Media Server to be a survivable call-processing server for remote/branch customer locations, as well as a redundant call controller for a standalone S8300 Media Server.

In the event that the communication link is broken between the remote Avaya™ G700 Media Gateway and the primary call controller (either an Avaya S8300 Server or an Avaya S8700 Server), the LSP will provide service for the Avaya IP Telephones and G700 Media Gateways that were controlled by the primary call controller. A large enterprise customer may have a main media server controlling multiple remote G700 Media Gateways configured with LSPs.

The strategy by which Avaya G700 Gateways and IP endpoints change control from the primary gatekeeper to the LSP is driven by the endpoints themselves, which use a list of gatekeepers. During initialization, each IP endpoint and G700 Gateway receives a list of gatekeepers. The IP endpoints ask each gatekeeper in the list for service until one responds with a positive reply. If the link to that gatekeeper fails at some later time, the endpoint will try to receive service from the other gatekeepers in the list, including the LSP. The LSP will provide service to all G700s and IP endpoints that register with it. When the primary gatekeeper is prepared to provide service, the LSP needs to be manually reset. This will inform the IP endpoints to try their gatekeeper list again, and return to the primary gatekeeper for service.

The LSP provides redundancy in a variety of configurations and can be located anywhere in a network of G700 Gateways.

The LSP does not currently provide support for traditional port networks and it is not intended to provide reliability for an entire large network. The size of the processor and the IP network constraints dictate that an LSP serve only a subset of the network, such as a remote geographic location with a small or mid-sized office.

3. Definitions

CLAN : Control LAN, the TN799 circuit pack
DHCP : Dynamic Host Configuration Protocol
MGP : Media Gateway Processor
SAT : System Access Terminal
SNMP : Simple Network Management Protocol

4. Configurations

The LSP can be the backup gatekeeper for an Avaya S8700 Server. Support for the LSP as a backup gatekeeper for the S8300 server is targeted for second Quarter 2003. The LSP can control a number of G700 Gateways and a subset of the total number of IP telephones. The diagram below shows LSPs in both a branch office and a mid-size office.

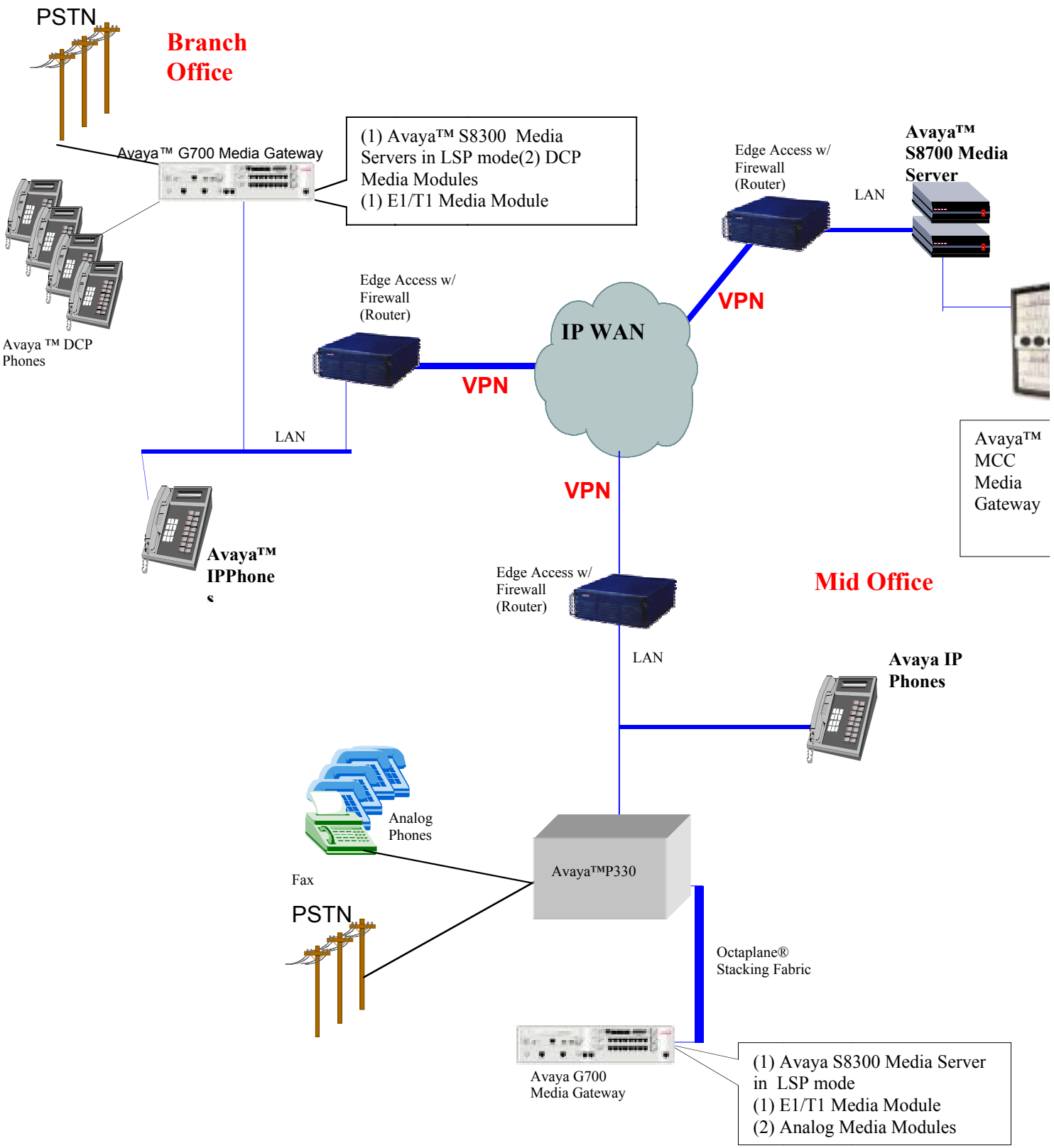

Figure 1: Examples of various locations of LSPs within a network

5. Administration

The LSP must be administered to know where the primary call controller is so that a registration and heartbeat will occur between the LSP and the primary call controller. This administration on the LSP is done during the configuration stage through the configure server web page.

Starting with Avaya MultiVantage Software Release 1.3 (Planned 2003 release), the primary gatekeeper will also be administered to know about each of the LSPs via programming on the System Administration Terminal (SAT). This added feature will provide security against a registration from a false LSP that would then impair the remaining LSPs. Additionally, as LSPs become available for translation transfers, the primary gatekeeper's SAT will show this information.

6. Translations

The primary gatekeeper sends a complete copy of the Media Server translations to the LSP. Once the LSP has contacted the primary gatekeeper, the primary gatekeeper saves the location of the LSP and records that it is ready for translations to be transferred. Then, when a save translations command is run (either manually or through the scheduled maintenance), a file transfer occurs to each of the LSPs that are in the primary gatekeeper's list. Once the transfer has completed to the LSP, a reset of Avaya MultiVantage Software automatically occurs on each LSP in order for the LSP to read in all changes made to translations.

Each LSP is running MultiVantage Software all the time, but it is only when the G700 registers that the LSP becomes active and begins processing calls. When the LSP is active, translations may still be transferred from the primary gatekeeper, but the LSP will recognize that it is active and not read in the new translations until it is no longer performing call processing.

The translation transfer will only happen from the primary call controller to the LSPs. Because there may be multiple LSPs in a system, translations are not transferred back to the primary call controller to maintain the integrity of the translations. The LSP allows administration changes, allowing for a flexible emergency system, but those changes cannot be saved on the LSP.

7. Preparing for transition to an LSP

The LSP will serve any registering endpoints in the event of a network failure or when the primary call controller is unable to provide service. The transition sequence is driven by the endpoints; in order for a transition to happen properly in either case, the IP telephones and Avaya G700 Gateways must be administered to know where the LSP resides.

7.1 IP Telephones

The IP telephones perform a DHCP discovery sequence to obtain their own IP addresses during initialization. During this dialog with the DHCP server, the IP telephones obtain a list of the call server addresses that includes LSPs. It is recommended that each LSP serve all the telephones within a subnet or a group of subnets and the DHCP server should have each subnet administered with its own LSP in the list of call server addresses.

Since the list of call server addresses is searched sequentially, any CLAN desired for registration is listed first, followed by the LSP that is serving that subnet. When the telephone registers with a CLAN, the telephone and the Avaya MultiVantage Software exchange a series of messages. From these messages, the telephones are load-balanced across CLANs in network regions. Once registered, the telephone is also given a list of alternate CLANs within its network region that can be used in the case of a loss of communication later.

Starting with Avaya MultiVantage Software Release 1.3 (Planned2003 release), each network region can be assigned up to six (6) LSPs. On the SAT of the main server, each network region will accept a list of LSPs, and that list of LSPs will be sent to the IP phones in that network region as part of the alternate gatekeeper list. Each network region can be defined to have multiple LSPs as backups, and each LSP can be administered to support multiple network regions.

7.2 Avaya G700 Gateways

Avaya G700 Gateways must be administered manually through the command line interface (CLI) of the media gateway processor (MGP). The media gateway controller (MGC) list holds up to four (4) IP addresses. This list must be carefully configured since it is the only list the G700 uses for recovery. There are several attributes associated with this list that determine the behavior of the G700 Gateway during a recovery situation. These attributes are discussed in sections 7.2.1 to 7.2.3 and behave as described in the Avaya MultiVantage Software Release 1.3.

7.2.1 Transition Point

The transition point marks a group of IP addresses being the most important for the Avaya G700 Gateway to reach during its search for a gatekeeper. If the transition point is designated to be two, the G700 Gateway will attempt to contact the first two addresses on the list for the duration of the primary search time, after which it will begin a circular search of the entire list for the duration of the Total Search time.

7.2.2 Primary Search Time

This defines the amount of time the Avaya G700 Gateway will search the addresses that are included in the transition point. When the G700 Gateway is searching the addresses in the primary portion of the list (i.e., the list of addresses before the transition point), it tries each address once and continues down the list. When it hits the transition point, it starts again at the beginning of the list. Once the primary search time

expires, the G700 Gateway continues past the transition point and tries the remaining addresses once each before returning to the top.

7.2.3 Total Search Time

This time defines how long the Avaya G700 Gateway will search its list before performing a hard reset of the MGP and a restart of the search process.

The following examples use the same primary and total search times, and are used to illustrate the effect of changing the transition point on the overall recovery time and how an administrator can control the connectivity priorities for each location in a system.

Example 1:

Primary search time: 1 minute
Transition point: 1
Total search time: 30 minutes
1 CLAN1
Transition point
2 LSP

The emphasis in Example 1 is to transfer control to the LSP quickly and reduce the downtime during the transfer by having a single CLAN above the transition point and the LSP after. If the Avaya G700 Gateway is registered to CLAN1 when there is a network outage between the G700 Gateway and the primary gatekeeper, the G700 will first attempt re-registration with the CLAN before continuing with the circular search through the list.

Once the Avaya G700 Gateway is able to reach a gatekeeper, the MGP will reset and begin the search at the top of the list once again. At this point, the G700 Gateway will try the CLAN and then the LSP.

If the Avaya G700 Gateway is unable to reach the LSP, the G700 Gateway will start its search at the top of the list. If the G700 continues in this fashion and is unable to reach a gatekeeper for duration of the total search time, the MGP will reset and start at the top of the list.

Example 2:

Primary search time: 1 minute
Transition point: 2
Total search time: 30 minutes
1 CLAN1
2 CLAN2
Transition point
3 LSP

Example 2 puts the emphasis on maintaining a fully-connected network by having two CLANs above the transition point and the LSP after. If the Avaya G700 Gateway is

registered to CLAN1 when there is a network outage between the G700 Gateway and the primary gatekeeper, the G700 will attempt to re-register with CLAN1, then continue down the list trying to register with CLAN 2, then the LSP.

If the Avaya G700 Gateway is able to reach the LSP, the MGP will reset and begin the search at the top of the list once again, attempting one registration with each address in the list.

If the Avaya G700 Gateway is unable to reach the LSP, the G700 Gateway will start its search at the top of the list. If the G700 continues in this fashion and is unable to reach a gatekeeper for duration of the total search time, the MGP will reset and start at the top of the list.

8. Transition to the LSP

8.1 Avaya G700 Gateway

The transition to the LSP is an automatic process. When an endpoint determines that it can no longer communicate with the primary gatekeeper, it searches its list of gatekeeper candidates until it finds one that responds to the registration request and allows the endpoint to register.

The Avaya G700 Gateway will determine that it does not have connectivity with the primary gatekeeper and then search for the next available gatekeeper. Once contact can be made with a new gatekeeper, the MGP reboots in order to synchronize the call states on the G700 Gateway with the call states on the new gatekeeper. Any calls that are up at the time of the failure will remain up until the G700 finds a new gatekeeper and resets the call states. When the G700 is in this state, no features can be used, nor can new calls be made until the G700 is re-registered with a gatekeeper.

The amount of time an Avaya G700 Gateway takes to transition over to the LSP varies based on where the failure happened, the transition point and primary search time, and where LSPs are administered in the G700 Gateway gatekeeper list.

Avaya G700 Gateways send a keep alive message once every 24 seconds. If the failure occurs in the network, and the G700 Gateway does not receive a response to three keep-alive messages in a row, it will then enter into recovery mode and begin the search for a new gatekeeper. This takes a maximum of 72 seconds. If the failure occurs at the CLAN or the primary gatekeeper, the communication link is closed and the G700 is alerted to this closure immediately.

The next stage of a failover is the search time to find a new gatekeeper. The Avaya G700 Gateway will try to re-register with the same IP address first. If that address is unreachable, the Avaya G700 Gateway will continue through the list until it is able to register with one of the addresses. The best-case scenario is approximately 11 seconds.

Once the Avaya G700 Gateway makes contact with a gatekeeper, the MGP then undergoes a reboot, which takes approximately 40 seconds. This reboot is necessary to put the call states on the G700 Gateway in synch with the call states on the new gatekeeper.

Following the reboot, the search starts again at the beginning of the list. This allows the G700 the best chance to be registered with the primary gatekeeper, especially after a short network outage when the primary gatekeeper is still able to provide service and the link between the G700 and the primary gatekeeper has been restored.

Using the defaults of one-minute primary search time, a transition point of one, a total search time of 30 minutes, and one CLAN and one LSP with a network failure, here are the times involved in the Avaya G700 Gateway failover to an LSP:

Keep-alive failure : 72 seconds
(first) Search time attempt to the CLAN : 10 seconds
Connect to LSP : ~1 second (can be up to 10 seconds)
MGP reboot : 40 seconds
(second) Search time attempt to the CLAN: 10 seconds
Reconnect to LSP : ~1 second (can be up to 10 seconds)

Until the Avaya G700 Gateway reaches a second gatekeeper, all calls in progress will remain up, but without access to features. Any call that is attempted when the gateway is in its recovery stage will receive no dial tone until the G700 Gateway re-registers with a gatekeeper and is receiving call processing again. After the G700 reaches a second gatekeeper, the MGP resets and any DCP, analog, or trunked calls in progress at this time are torn down.

8.2 IP Telephone

Any IP-direct calls (In network - IP endpoint to IP endpoint) will stay up until both parties hang up, but will have no access to any features until a new call is originated. The telephone will enter into recovery mode when the users hang up. The LSP will deny IP phone registrations until at least one G700 has registered with the LSP. Until the G700 has registered, the LSP has no access to IP resources to serve the telephones, so this is a precautionary measure to ensure the highest quality of service once the transition to the LSP has occurred.

Once the primary call controller is ready to serve the endpoints being served by the LSP, the LSP must undergo a manual reset, and the endpoints will re-register with the primary call controller once again. A discussion about returning control to the main gatekeeper and recommendations is included later in this paper.

9. Communication

Any LSP that controls an Avaya G700 Gateway with a trunk, either to the PSTN or to other call controllers, will have access to that trunk. This is important because once LSPs are giving service to G700 Gateways and IP telephones, each LSP is its own switch and has no communication paths to other LSPs. Thus, a DCP phone on LSP1 can call a DCP phone on LSP2 through PSTN trunks maintained in each LSP. The same rule

applies for IP telephones registered to different LSPs; no direct calls between LSPs can be placed.

10. License modes

While the LSP is not controlling any endpoints, it is running in license normal mode. In license normal mode, the LSP is prepared at all times to provide service when called upon. Once an Avaya G700 Gateway registers with an LSP, that LSP enters into license error mode, which permits a limited time of call processing. This timer is intended to allow the user to fix the problem that caused the failover in a timely manner. Once the period of time has passed, the LSP enters into no license mode, and will not allow call processing.

When the problem has been fixed, the LSP must be manually reset and all endpoints will register with the primary call controller. After the reset and no subsequent registrations occur, the LSP will once again enter license normal mode. At this time, the license timer will be reset and the LSP will be ready for a new period of time of service in the event of another failure.

11. Alarming

The LSP will raise several alarms to alert services that the LSP is in service and that there is a problem either in the network or with the primary call controller. These alarms will be sent out through a modem or through SNMP over the Internet, depending on how the LSP has been administered during installation. While the LSP is running as either a non-active call controller or as an active call controller, any problems discovered through normal maintenance checks will also initiate alarms.

Each LSP sends keep alive messages to the primary call controller, continuing communications with the primary call controller as part of the translation transfer mechanism. If the LSP sends three keep alive messages and receives no response, it will raise an alarm to indicate that it is unable to reach its primary call controller. This alarm appears in “display alarms” as an ICC alarm and shows the time the alarm was raised. The host G700 Gateway must be administered with an S8300 Server in the ‘add media gateway’ form before this alarm will be displayed and will appear three minutes after the first time the LSP does not receive a response.

When the LSP receives its first registration from a G700 Gateway and enters license error mode, the LSP will raise an alarm indicating that it is in license error mode. This alarm appears in “display alarms” as LIC-ERR, and shows the time that the LSP entered license error mode.

When the G700 Gateway registers with the LSP, the LSP will raise an alarm that the H248 link is up. At the same time, the primary call controller will raise the converse alarm that the H.248 link is down to that G700 Gateway. This alarm should aid in finding the location of a network failure, as well as determining where endpoints are registered.

Each IP telephone registration will generate a warning on the LSP. Since warnings are not called out, this warning will only be seen when it is actively looked for and is only intended to assist in finding where each endpoint has registered. In addition to following the warnings to find which IP telephones are registered to the LSP, the command ‘list registered’ will display a list of extensions that are currently registered.

12. Transition Back to the Primary Call Controller

The return of service to the primary call controller requires manual intervention. The LSP must undergo a reset system 4, which will close all communication links with the LSP, forcing all endpoints to reregister with the primary call controller. This time to transition is again dependent upon the ordering and administration of alternate controller lists, but the initial discovery that the connection has been broken is immediate. Both IP endpoints and G700 Gateways will discover right away that the link is no longer usable and begin the search for another controller.

Since the return to the primary call controller is not call preserving, it is recommended that this outage be planned and only done when service will be the least affected.

13. Upgrades and License Files

The same Avaya MultiVantage Software version must be running on the LSPs that is running on the primary call controller in order to help ensure that the system translations will work on the LSP after the translations are transferred to the LSP. This requirement is enforced through the transfer mechanism, which will not run between a primary call controller and an LSP that do not have the same Avaya MultiVantage Software. LSPs should be upgraded first, and Avaya Call Processing Software on the LSPs should be left out of service while the software upgrade is being completed on the primary call controller. The LSP Avaya MultiVantage Software upgrade is a manual process and requires that each LSP be upgraded individually.

The license file turns on the LSP feature bit and activates the LSP. The license file for the Avaya S8300 Gateway, as a survivable processor or as a standalone, keys off of the serial number of the hosting Avaya G700 Gateway. Therefore, each LSP requires its own license file to be loaded. This license must match or exceed the primary call controller's in capacity limits in order to allow the primary controller's translations to load on the LSP without exceeding the limits set by the license file.

14. Conclusion:

Traditionally, duplication of data has been done by a call processor, which protects against server difficulties and provides this protection invisibly. When increasing the distances between headquarters and remote branch offices however, it becomes more likely that a network outage causes a loss of communications. Setting up Local Survivable Processors on corporate networks provides coverage with full feature functionality in the event of a network outage. With the Avaya MultiVantage Software based solutions, the system administrator is empowered to select which strategy for recovery is priority: reconnecting the location to the network for interoffice communications, or reestablishing local call traffic. Avaya's S8300 Media Server can be established as an LSP in a network controlled by an Avaya S8700 Media Server.